Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

January 4, 2017

Project No. 11515.001

Murrieta Valley Unified School District
41870 McAlby Court
Murrieta, California 92562

Attention: Mr. Randy White

Subject: Pavement Design and Percolation Testing
Proposed Alta Murrieta Elementary School Parking Lot
39475 Whitewood Road, Murrieta, California

In accordance with your request and authorization, we are pleased to present this percolation testing and pavement design report for the proposed parking lot expansion located at Alta Murrieta Elementary School.

INTRODUCTION

Purpose and Scope of Work

The purpose of our study is to evaluate the subgrade soils conditions at this site in order to provide pavement design recommendations and percolation rates for the proposed parking lot expansion and associated onsite infiltration basin. More specifically, our scope of services included the following:

- Review of available site-specific geologic information and provided site plan.
- A site reconnaissance and excavation of one (1) deep exploratory boring, two (2) shallow percolation percolation/infiltration tests and one (1) deep drywell percolation/infiltration test. Approximate locations of these borings/tests are depicted on Figure 1. The logs of borings and percolation test results are presented in Appendix A.
- Geotechnical laboratory testing of selected soil samples collected during this exploration. Test results are presented in Appendix A.
- Geotechnical engineering analyses performed or as directed by a California registered Geotechnical Engineer (GE) and reviewed by a California Certified Engineering Geologist (CEG).
- Preparation of this report which presents our findings and recommendations regarding the proposed improvements.

This report is not intended to be used as an environmental site assessment (Phase I or other), or grading plan review.

Site Location and Project Description

The overall campus is located at 39475 Whitewood Road, in the City of Murrieta, California. We understand that the proposed parking lot is to be located on the east side of the school, just north of the existing ball field, paralleling Whitewood Road (see Figure 1).

Based on the results of our site reconnaissance and review of in house data, the site of the proposed parking area is underlain by previously placed artificial fill. A proposed basin, which is expected to be approximately 4 feet in depth, is also proposed east of the parking lot. We understand that a deep dry well option is being considered in the middle of the parking lot if shallow infiltration basin is not feasible. Site grading is expected to be minimal (±2 feet).

Field Exploration

Our field exploration consisted of the excavation of one (1) deep exploratory boring, two (2) shallow percolation/infiltration tests and one (1) deep drywell percolation/infiltration test. During exploration, disturbed/bulk samples were collected from the borings/ percolation tests for further laboratory testing and evaluation. Approximate locations of these exploratory borings are depicted on the *Boring Location Plan* (Figure 1). Sampling was conducted by a staff geologist from our firm. After logging and sampling, the excavations were loosely backfilled with spoils generated during excavation. The exploration logs from this exploration are included in Appendix A.

Laboratory Testing

Laboratory tests were performed on representative bulk and undisturbed samples to confirm engineering properties previously explored for the onsite soils. Selected samples were tested to determine the following parameters: in-situ moisture and density, expansion index, and R-Value. The results of our laboratory testing are presented in Appendix A.

FINDINGS AND CONCLUSIONS

Subsurface Conditions

Our field exploration indicates that the site is underlain by artificial fill. This fill generally consists of moist to wet sandy clay to clayey sand (CL/SC) to a depth of approximately 21 feet. At greater depth, the fill becomes less clayey and consisted primarily of silty sand materials (SM). The near surface clayey sand soils possess an R-value of 9.

Pauba Formation bedrock materials were encountered at depth of 40 feet in our deep exploratory boring. As encountered, the Pauba Formation consisted of very dense, silty sand with gravel.

Groundwater and Surface Water

No surface or groundwater was encountered during this exploration. Groundwater is not anticipated to be encountered during grading or pavement construction.

Percolation/Infiltration Testing

Four percolation tests were performed in designated areas within the site (see Figure 1) in general accordance with the procedures of the Riverside County Flood Control and Water Conservation District (RCFC&WCD) Design Handbook (RCFC, 2011). Two shallow percolation tests (P-1 and P-2) were performed at the location of the proposed basin at depths of approximately 4 feet below ground surface (bgs). The results of this testing is presented Table 1 below in minutes-per-inch drop and converted into infiltration rates (In/hr) using the Porchet Method.

Table 1. Summary of Percolation/Infiltration Test Results - Shallow

Test Hole #	Location	Depth BGS (ft)	Percolation Rate (min/in)	Infiltration Rate (in/hr)	Soil Description
P-1	Proposed Detention Basin Area	4	0	0	Clayey SAND and Sandy CLAY (SC-CL) / Artificial Fill
P-2		4	120	0.05	

As reflected in the above test results, the onsite soils possess poor percolation/ infiltration rates. In fact, test P-1 indicates virtually impermeable soil conditions.

A deep percolation test (DW-1) was performed to a depth of 25 feet below ground surface (bgs) for the purpose of dry well design. The results of this testing is presented in Table 2 below

Table 2. Summary of Percolation/Infiltration Test Results - Deep

Test Hole #	Location	Depth BGS (ft)	Percolation Rate (gal/sqft of sidewall per day)	Soil Description
DW-1	Parking Lot Area	25	0.73	Clayey SAND and Sandy CLAY (SC-CL) / Artificial Fill

The test results also indicate relatively poor percolation/ infiltration rates for the purpose of dry well design.

PAVEMENT RECOMMENDATIONS

Subgrade Preparation/Remedial Grading

Prior to grading, the proposed improvement area should be cleared of surface and subsurface obstructions. Heavy vegetation/grass, roots and debris should be disposed of offsite. Voids created by removal of buried material should be backfilled with properly compacted soil. Irrigation of the grass areas should be stopped prior to construction. Remedial grading should consist of recompaction of upper 3 feet of soils. The actual depth of the removal/over-excavation should be verified by the geotechnical consultant during grading. After completion of the recommended removal of unsuitable soils and prior to fill placement, the exposed surface should be scarified to a minimum depth of 8-inches, moisture conditioned as necessary to near optimum moisture content and recompacted using heavy compaction equipment to an unyielding condition. Some of the onsite soils may require drying back to near optimum content in order to achieve the required compaction. All structural fill should be compacted throughout to 90 percent of the ASTM D 1557 laboratory maximum density, at/or near optimum moisture.

Pavement Design and Construction

Our preliminary pavement design is based on an R-value of 9 and the Caltrans Highway Design Manual. For planning and estimating purposes, the pavement sections are calculated based on Traffic Indexes (TI) as indicated in Table below.

Table 3. Recommended Pavement Sections

General Traffic Condition	Design Traffic Index (TI)	Asphalt Concrete (inches)	Aggregate Base* (inches)
Automobile Parking Lanes	4.5	3.0	7.5
	5.0	3.0	9.0
Bus Access & Driveways	6.0	3.5	12.0
	6.5	3.5	14.0

Appropriate Traffic Index (TI) should be selected or verified by the project civil engineer and actual R-value of the subgrade soils will need to be verified after completion of site grading to finalize the pavement design. Pavement design and construction should also conform to applicable local, county and industry standards. The Caltrans pavement section design calculations were based on a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance.

Where applicable, we recommend that a minimum of 6 inches of PCC pavement be used, in high impact load areas or if to be subjected to truck/bus traffic. The PCC pavement should be placed on a minimum 6-inch aggregate base. The PCC pavement should have a minimum of 28-day flexural strength of 570 psi. Other requirements of Caltrans Standard Specifications regarding mixing and placing of concrete should be followed.

The upper 8 inches of the subgrade soils should be moisture-conditioned to near optimum moisture content, compacted to at least 95 percent relative compaction (ASTM D1557) and kept in this condition until the pavement section is constructed. Minimum relative compaction requirements for aggregate base should be 95 percent of the maximum laboratory density as determined by ASTM D1557. If applicable, aggregate base should conform to the “Standard Specifications for Public Works Construction” (green book) current edition or Caltrans Class 2 aggregate base.

If pavement areas are adjacent to heavily watered landscape areas, some deterioration of the subgrade load bearing capacity may result. Moisture control measures such as deepened curbs or other moisture barrier materials may be used to prevent the subgrade soils from becoming saturated. The use of concrete cutoff or edge barriers should be considered when pavement is planned adjacent to either open (unfinished) or irrigated landscaped areas

GEOTECHNICAL CONSTRUCTION SERVICES

We recommend that Leighton Consulting, Inc. be provided the opportunity to review the grading/improvement plans to confirm that the geotechnical aspects of the project are in conformance with our recommendations.

Reasonably-continuous construction observation and review during site grading and foundation installation allows for evaluation of the actual soil conditions and the ability to provide appropriate revisions where required during construction. Geotechnical conclusions and preliminary recommendations should be reviewed and verified by Leighton Consulting, Inc. during construction, and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations.

Additional geotechnical exploration and analysis may be required based on final development plans, for reasons such as significant changes in proposed structure type, and location/footprints. We should review grading (civil) and foundation (structural) plans, and comment further on geotechnical aspects of this project.

LIMITATIONS

This addendum report was based in part on data obtained from a limited number of observations, site visits, soil excavations, samples and tests. Such information is, by necessity, incomplete. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, our findings, conclusions and recommendations presented in this report are based on the assumption that we (Leighton Consulting, Inc.) will provide geotechnical observation and testing during construction as the Geotechnical Engineer of Record for this project.

This report was prepared for the sole use of Client and their design team, for application to design of the Proposed Alta Murrieta Elementary School Parking Lot, in accordance with generally accepted geotechnical engineering practices at this time in California. This report is not meant to comply with Note 48 of the California Geological Survey (CGS). Any unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton Consulting, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton Consulting, Inc.

If you have any questions regarding this report, please do not hesitate to contact the undersigned. We appreciate this opportunity to be of service on this project.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Simon I. Saiid, GE 2641
Principal Engineer

Robert F. Riha, CEG 1921
Senior Principal Geologist

Attachments: References
Figure 1 – Site Location Map
Figure 2 – Boring/Percolation Test Location Map
Appendix A – Logs of Exploratory Borings and Lab Testing Results

Distribution: (1) Addressee (1 PDF copy via email)
(1) Mr. Buddy Gessel (1 PDF copy to bgessel@bndesignstudio.com)

REFERENCES

California Geological Survey, (CGS), 2006, Geologic Map of the San Bernardino and Santa Ana 30' X 60' Quadrangle, Southern California, Version 1.0, Compiled by Douglas M. Morton and Fred K. Miller, Open File Report 06-1217.

Hart, E.W., Bryant, W. A., 2007, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning with Index to Earthquake Zones Maps: Department of Conservation, Division of Mines and Geology, Special Publication 42. Interim Revision 2007.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas, California Division of Mines and Geology, Geologic Data Map Series, No. 6, Scale 1:750,000.

Leighton Consulting Inc., 2012, Geotechnical Exploration for Solar Shade Structures, Alta Murrieta Elementary School, 39475 Whitewood Avenue, Murrieta, California, Murrieta, California, Project No. 603317-001, dated March 6.

Public Works Standard, Inc., 2015, Greenbook, Standard Specifications for Public Works Construction: 2015 Edition, BNI Building News, Anaheim, California.

Project: 11515.001	Eng/Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: December 2016

Base Map: ESRI ArcGIS Online 2016
Thematic Information: Leighton
Author: (mmurphy)

SITE LOCATION MAP

Jerry Eaves Park Percolation Testing
City of Rialto, California

Figure 1

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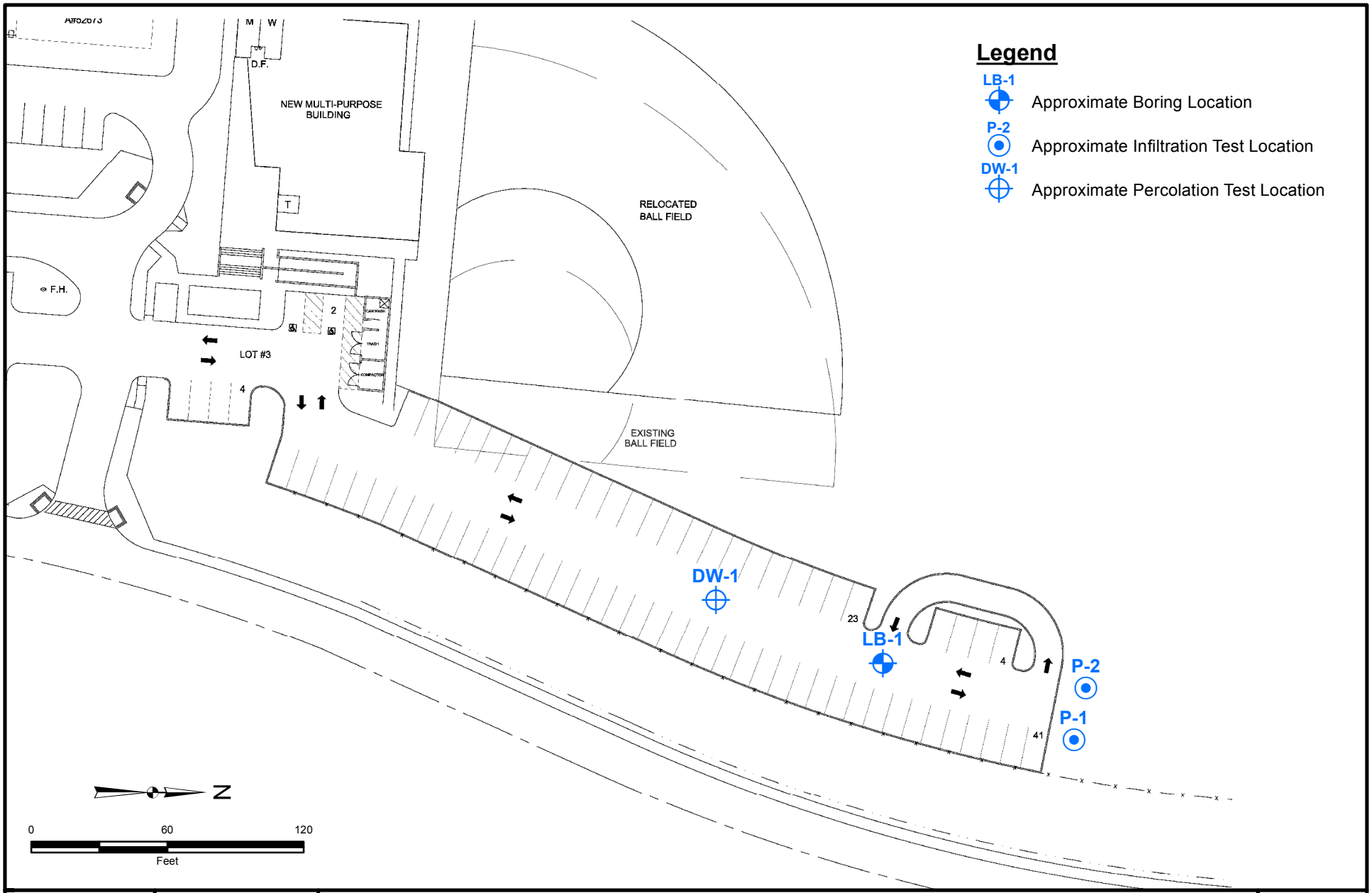
Map Saved as P:\Drafting\11515\001\Maps\11515-001_F01_SLM_2016-12-29.mxd on 12/29/2016 2:55:55 PM



Project: 11515.001	Eng/Geol: SIS/RFR
Scale: 1 " = 60 '	Date: December 2016

Reference: Drawing A.0.2, Enlarged Site Plan-Parking Expansion, Option 3A by Baker Nowicki Design Studio for Alta Murrieta Elementary School Parking Expansion, dated 11/10/2016.
Author: (mmurphy)

BORING/PERCOLATION TEST LOCATION MAP

Alta Murrieta Elementary School Parking Lot
39475 Whitewood Road
Murrieta, California

Figure 2

Leighton

Map Saved as P:\Drafting\11515\001\Maps\11515-001_F02_BLM_2016-12-29.mxd on 12/30/2016 8:28:33 AM

APPENDIX A

LOGS OF EXPLORATORY BORINGS AND LABORATORY TESTING RESULTS

GEOTECHNICAL BORING LOG DW-1

Project No.	11515.001	**Date Drilled**	12-19-16
Project	Alta Murrieta Elementary School Parking Lot/Perc Testing	**Logged By**	JTD
Drilling Co.	California Pacific Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Auto Hammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								At surface: Grass	
								CL	**Artificial Fill (Af)**; SANDY Lean CLAY, dark grayish brown, moist, fine to coarse grained sand	
								SC	CLAYEY SAND, dark brown, moist to wet, fine to coarse sand	
	5									
									CLAYEY SAND, dark grayish brown, moist, fine to coarse sand	
	10									
	15							CL	SANDY Lean CLAY, dark brown, moist, fine to coarse sand	
	20							SC	CLAYEY SAND, dark grayish brown, moist, fine and coarse sand	
								SM	SILTY SAND, dark grayish brown, moist, fine to coarse sand	
	25								Drilled to 25' Sampled to 25' Groundwater not encountered Backfilled with cuttings	
	30									

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-1

Project No.	11515.001	**Date Drilled**	12-19-16
Project	Alta Murrieta Elementary School Parking Lot/Perc Testing	**Logged By**	JTD
Drilling Co.	California Pacific Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Auto Hammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								At surface: Grass	
				B-1			9.7	SC	**Artificial Fill (Af)**; CLAYEY SAND, dark grayish brown, moist to wet, fine to coarse grained sand (MD: 133.5 @ 7.7, EI = 5, RV = 9)	
								SM	SILTY SAND, dark yellowish brown, moist, fine to coarse sand	
	5			S-1	2 2 2		13.2	SC	CLAYEY SAND, loose, dark brown, moist to wet, fine to coarse sand	
								CL	SANDY Lean CLAY, dark grayish brown, moist to wet, fine to coarse sand	
	10			S-2	4 5 8		11.9	SC	CLAYEY SAND with GRAVEL, medium dense, dark grayish brown, moist, fine to coarse sand, difficult drilling at 15'	
	15									
	20			S-3	6 12 13			CL	SANDY Lean CLAY, very stiff, dark grayish brown, moist, fine to coarse sand	
	25								SILTY SAND, dark grayish brown, moist, fine to medium grained sand	
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
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- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-1

Project No.	11515.001	**Date Drilled**	12-19-16
Project	Alta Murrieta Elementary School Parking Lot/Perc Testing	**Logged By**	JTD
Drilling Co.	California Pacific Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Auto Hammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	30			S-4	6 4 3			SM	SILTY SAND, loose, dark grayish brown, moist, fine sand	
	35									
	40			S-5	17 25 27				**Pauba Formation (Qps)**; SILTY SAND with GRAVEL, very dense, light brownish gray, moist, fine to coarse grained sand	
									Drilled to 41.5' Sampled to 41.5' Groundwater not encountered Backfilled with cuttings	
	45									
	50									
	55									
	60									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG P-1

Project No.	11515.001	**Date Drilled**	12-19-16
Project	Alta Murrieta Elementary School Parking Lot/Perc Testing	**Logged By**	JTD
Drilling Co.	California Pacific Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Auto Hammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0								At surface: Grass	
								CL	**Artificial Fill (Af)**; SANDY Lean CLAY, dark grayish brown, moist to wet, fine to coarse grained sand	
								SM	SILTY SAND, dark grayish brown, moist, fine to coarse sand, some clay, SA: 30% fines	
				S-1						
	5								Drilled to 4' Sampled to 4' Groundwater not encountered Backfilled with cuttings	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG P-2

Project No.	11515.001	**Date Drilled**	12-19-16
Project	Alta Murrieta Elementary School Parking Lot/Perc Testing	**Logged By**	JTD
Drilling Co.	California Pacific Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Auto Hammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								At surface: Grass	
								CL	**Artificial Fill (Af)**; SANDY Lean CLAY, dark brown, moist to wet, fine to coarse grained sand	
				S-1				SM	SILTY SAND, dark brown, moist to wet, fine to coarse sand, SA: 32% fines	
	5								Drilled to 4' Sampled to 4' Groundwater not encountered Backfilled with cuttings	
	10									
	15									
	20									
	25									
	30									

SOIL DESCRIPTION: This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name:	Alta Murrieta ES		Tested By:	FLM	Date: 12/30/16
Project No.:	11515.001		Checked By:	MRV	Date: 01/04/17
Exploration No.:	P-1		Depth (feet):	3.0 - 4.0	
Sample No.:	S-1				
Soil Identification:	Silty Sand (SM), Dark Brown.				

		Moisture Content of Total Air - Dry Soil	
Container No.:	123	Wt. of Air-Dry Soil + Cont. (g)	1813.5
Wt. of Air-Dried Soil + Cont.(g)	1813.5	Wt. of Dry Soil + Cont. (g)	1714.4
Wt. of Container (g)	699.6	Wt. of Container No._____ (g)	699.6
Dry Wt. of Soil (g)	1014.8	Moisture Content (%)	9.8

After Wet Sieve	Container No.	123
	Wt. of Dry Soil + Container (g)	1415.6
	Wt. of Container (g)	699.6
	Dry Wt. of Soil Retained on # 200 Sieve (g)	716.0

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.000		100.0
1"	25.000		100.0
3/4"	19.000		100.0
1/2"	12.500	0.0	100.0
3/8"	9.500	13.3	98.7
#4	4.750	38.4	96.2
#8	2.360	118.6	88.3
#16	1.180	247.8	75.6
#30	0.600	372.0	63.3
#50	0.300	499.8	50.7
#100	0.150	620.9	38.8
#200	0.075	709.1	30.1
PAN			

GRAVEL: **4 %**

SAND: **66 %**

FINES: **30 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = N/A

Cc = $(D30)^2/(D60*D10)$ = N/A

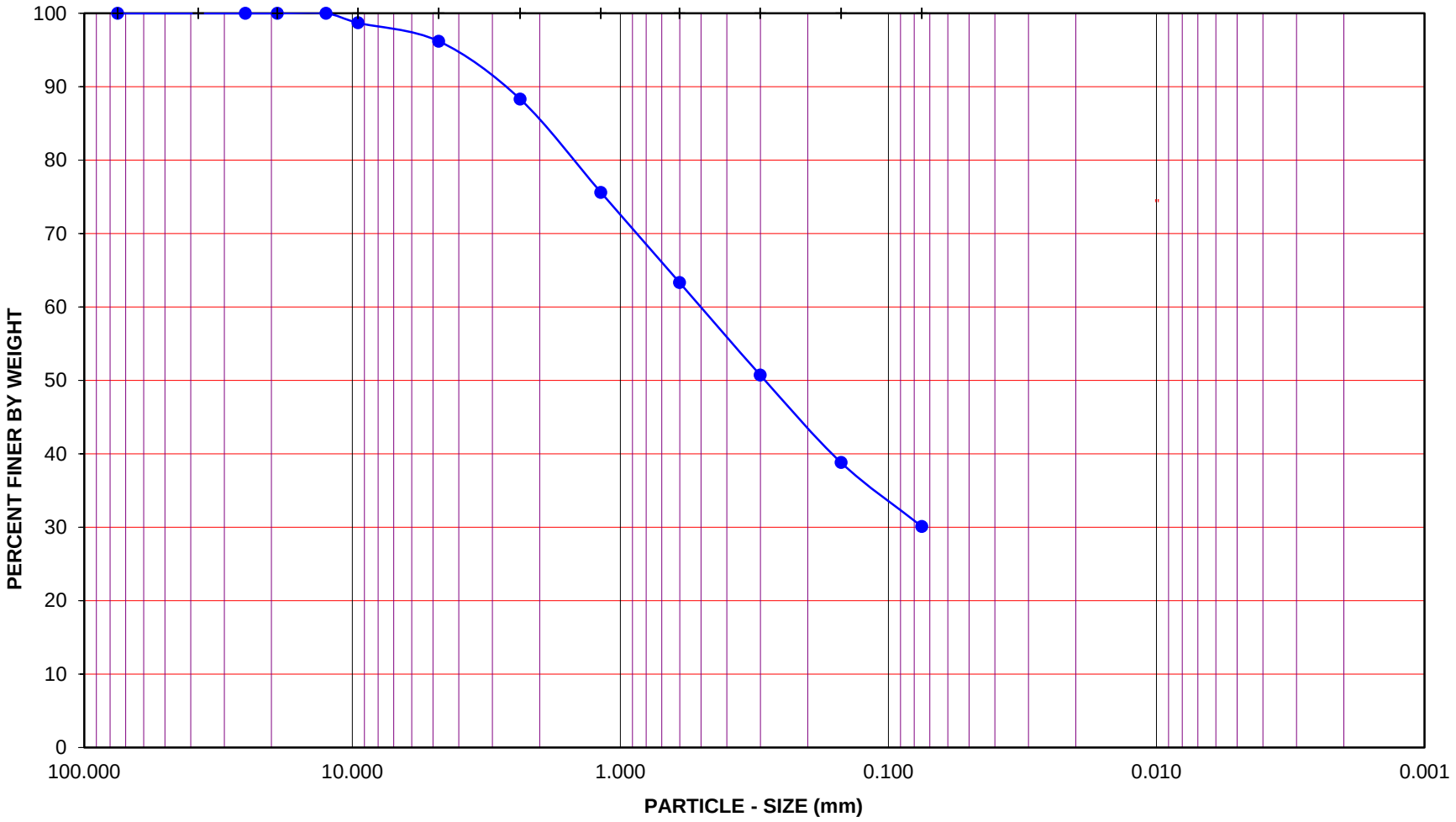
Remarks:

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING: 3.0" 1 1/2" 3/4" 3/8"

U.S. STANDARD SIEVE NUMBER: #4 #8 #16 #30 #50 #100 #200

HYDROMETER



Project Name: Alta Murrieta ES

Project No.: 11515.001

Exploration No.: P-1 Sample No.: S-1

Depth (feet): 3.0 - 4.0 Soil Type : #REF!

Soil Identification: Silty Sand (SM), Dark Brown.

GR:SA:FI : (%) 4 : 66 : 30

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PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Jan-17

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name:	Alta Murrieta ES		Tested By:	FLM	Date: 12/30/16
Project No.:	11515.001		Checked By:	MRV	Date: 01/04/17
Exploration No.:	P-2		Depth (feet):	3.0 - 4.0	
Sample No.:	S-1				
Soil Identification:	Silty Sand (SM), Dark Brown.				

		Moisture Content of Total Air - Dry Soil	
Container No.:	T	Wt. of Air-Dry Soil + Cont. (g)	2060.2
Wt. of Air-Dried Soil + Cont.(g)	2060.2	Wt. of Dry Soil + Cont. (g)	1935.9
Wt. of Container (g)	972.0	Wt. of Container No._____ (g)	972.0
Dry Wt. of Soil (g)	963.9	Moisture Content (%)	12.9

After Wet Sieve	Container No.	T
	Wt. of Dry Soil + Container (g)	1631.6
	Wt. of Container (g)	972.0
	Dry Wt. of Soil Retained on # 200 Sieve (g)	659.6

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.000		100.0
1"	25.000		100.0
3/4"	19.000		100.0
1/2"	12.500		100.0
3/8"	9.500	0.0	100.0
#4	4.750	23.6	97.6
#8	2.360	96.5	90.0
#16	1.180	200.5	79.2
#30	0.600	305.8	68.3
#50	0.300	427.5	55.6
#100	0.150	552.5	42.7
#200	0.075	652.7	32.3
PAN			

GRAVEL: **2 %**

SAND: **66 %**

FINES: **32 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = N/A

Cc = $(D30)^2/(D60*D10)$ = N/A

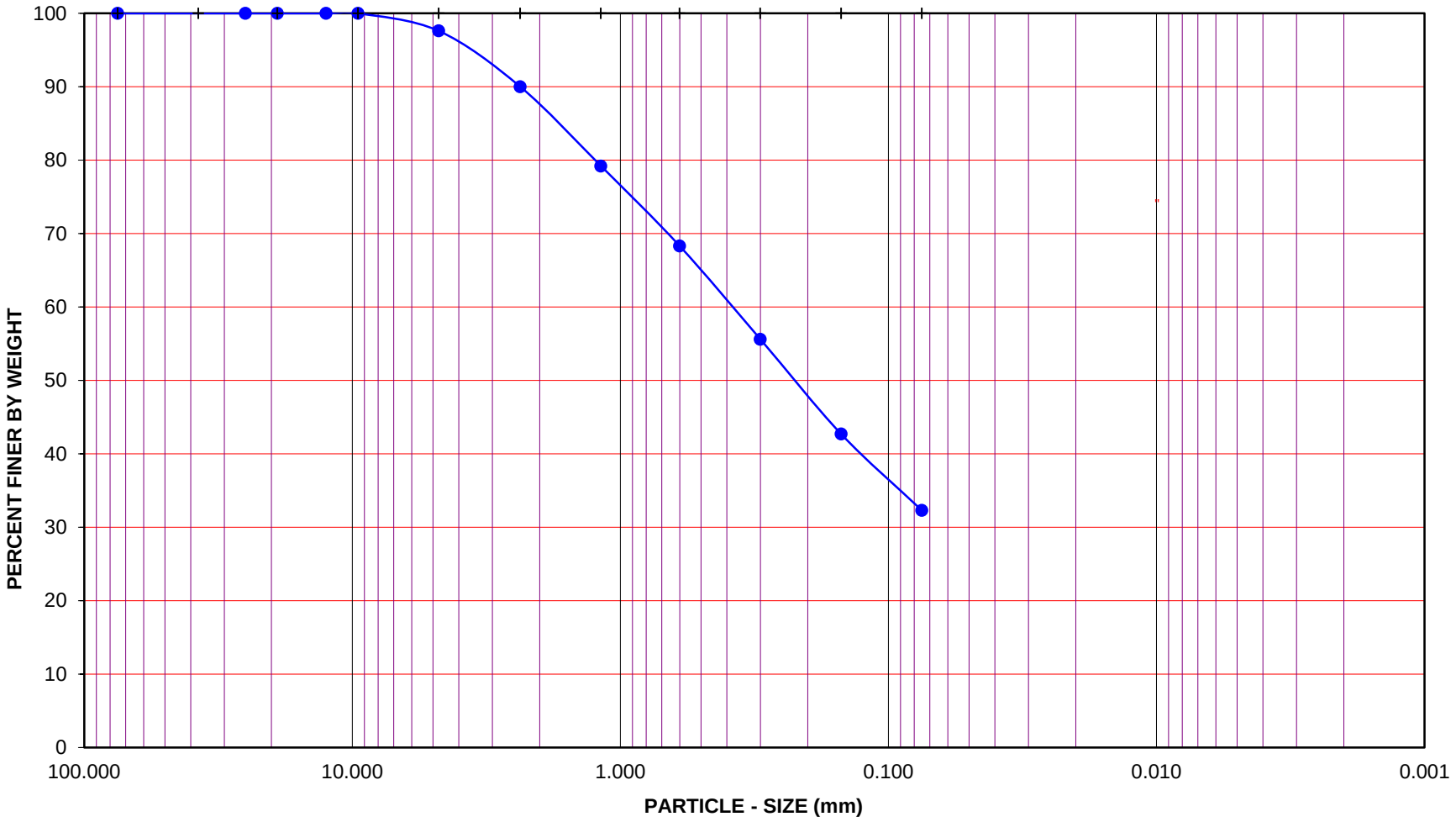
Remarks:

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING: 3.0" 1 1/2" 3/4" 3/8"

U.S. STANDARD SIEVE NUMBER: #4 #8 #16 #30 #50 #100 #200

HYDROMETER



Project Name: Alta Murrieta ES

Project No.: 11515.001

Exploration No.: P-2 Sample No.: S-1

Depth (feet): 3.0 - 4.0 Soil Type : #REF!

Soil Identification: Silty Sand (SM), Dark Brown.

GR:SA:FI : (%) 2 : 66 : 32

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PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Jan-17

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MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	Alta Murrieta ES	Tested By :	F. Mina	Date:	12/30/16
Project No.:	11515.001	Input By :	M. Vinet	Date:	1/4/17
Exploration No.:	LB-1	Depth (ft.)	0 - 5.0		
Sample No. :	B-1				
Soil Identification:	Clayey Sand (SC), Dark Brown.				

Preparation Method: [X] Moist [ ] Dry — [ ] Mechanical Ram [X] Manual Ram

Mold Volume (ft³) 0.03330 *Ram Weight = 10 lb.; Drop = 18 in.*

Moisture Added (ml)	-100	-50	0	50		
TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	6145	6315	6302	6230		
Weight of Mold (g)	4150	4150	4150	4150		AS REC'D
Net Weight of Soil (g)	1995	2165	2152	2080		MOISTURE
Wet Weight of Soil + Cont. (g)	608.2	586.8	736.3	808.2		747.7
Dry Weight of Soil + Cont. (g)	598.8	575.3	708.2	768.0		707.1
Weight of Container (g)	420.8	420.6	419.6	420.5		289.6
Moisture Content (%)	5.3	7.4	9.7	11.6		9.7
Wet Density (pcf)	132.1	143.3	142.5	137.7		
Dry Density (pcf)	125.5	133.4	129.8	123.4		

Maximum Dry Density (pcf) 133.5 **Optimum Moisture Content (%)** 7.7

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

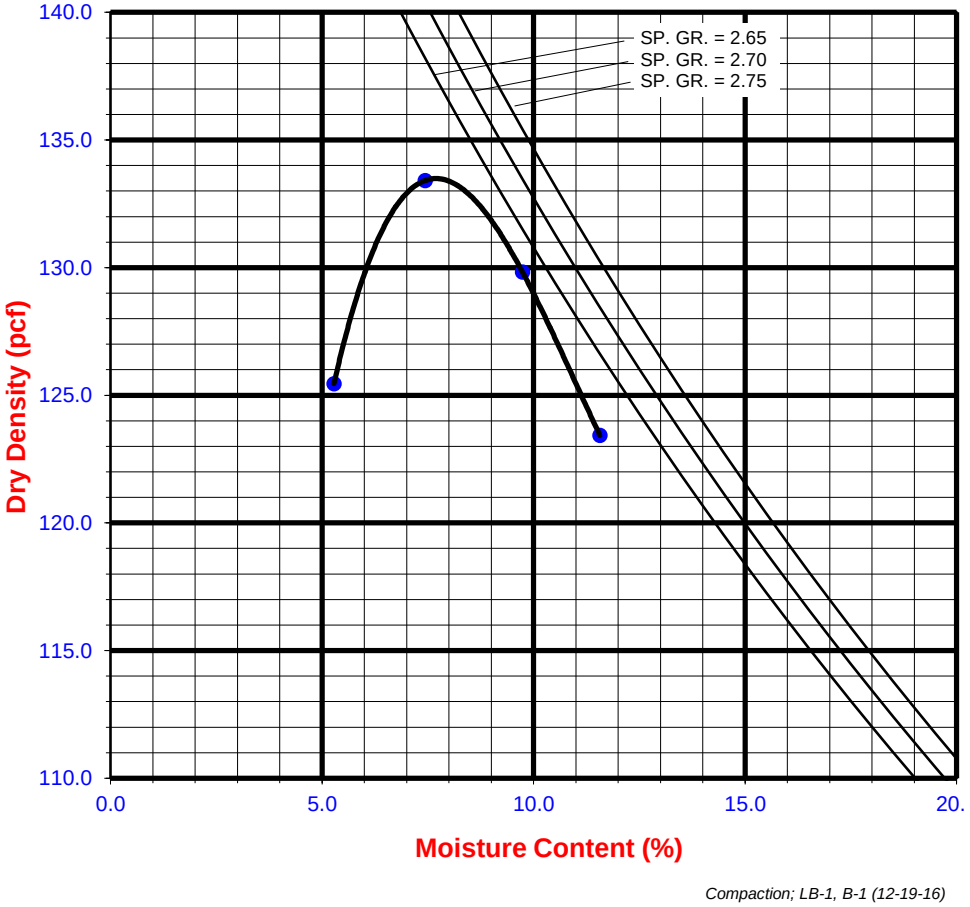
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Alta Murrieta ES		Tested By: F. Mina	Date:	12/29/16
Project No. :	11515.001		Checked By: M. Vinet	Date:	1/4/17
Boring No.:	LB-1		Depth: 0 - 5.0		
Sample No. :	B-1		Location: N/A		
Sample Description:	Clayey Sand (SC), Dark Brown.				

Dry Wt. of Soil + Cont. (gm.)	2614.7
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2614.7
Weight Soil Retained on #4 Sieve	83.0
Percent Passing # 4	96.8

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0049
Wt. Comp. Soil + Mold (gm.)	611.7	635.1
Wt. of Mold (gm.)	200.7	200.7
Specific Gravity (Assumed)	2.70	2.70
Container No.	8	8
Wet Wt. of Soil + Cont. (gm.)	715.1	635.1
Dry Wt. of Soil + Cont. (gm.)	691.6	378.8
Wt. of Container (gm.)	415.1	200.7
Moisture Content (%)	8.5	14.7
Wet Density (pcf)	124.0	130.4
Dry Density (pcf)	114.3	113.7
Void Ratio	0.475	0.483
Total Porosity	0.322	0.326
Pore Volume (cc)	66.7	67.7
Degree of Saturation (%) [S meas]	**48.3**	**82.1**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
12/29/16	10:45	1.0	0	0.5000
12/29/16	10:55	1.0	10	0.4998
	Add Distilled Water to the Specimen			
12/30/16	8:00	1.0	1265	0.5049
12/30/16	9:00	1.0	1325	0.5049

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	5.1
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Height	**5**

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R-VALUE TEST RESULTS

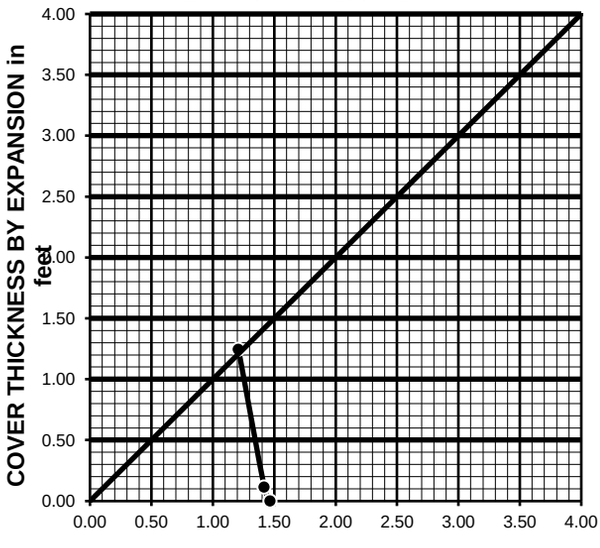
ASTM D 2844

Project Name:	Alta Murrieta ES	Date:	1/3/17
Project Number:	11515.001	Technician:	M. Vinet
Boring Number:	LB-1	Depth (ft.):	0 - 5.0
Sample Number:	B-1	Sample Location:	N/A
Sample Description:	Clayey Sand (SC), Dark Brown.		

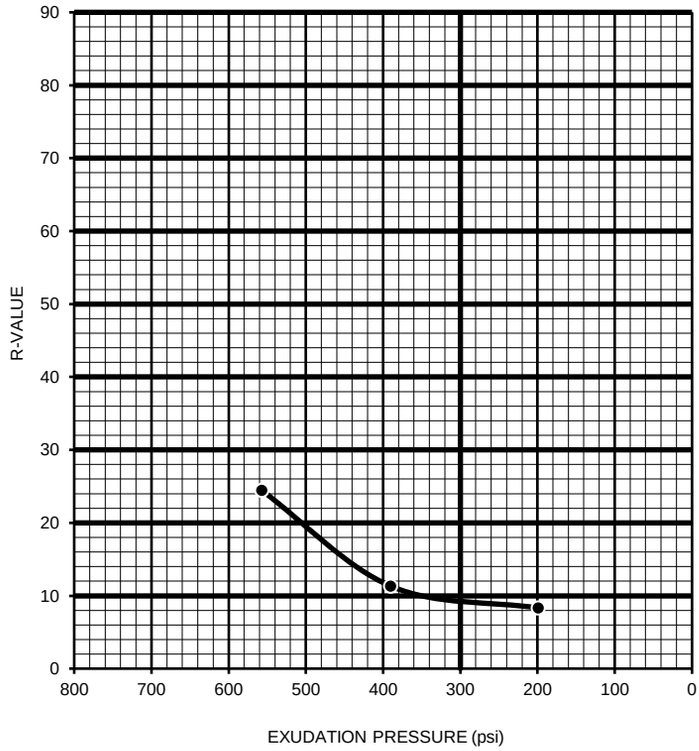
TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	10.0	11.1	12.2
HEIGHT OF SAMPLE, Inches	2.51	2.55	2.54
DRY DENSITY, pcf	128.1	126.1	122.9
COMPACTOR AIR PRESSURE, psi	300	125	100
EXUDATION PRESSURE, psi	557	390	199
EXPANSION, Inches x 10exp-4	33	3	0
STABILITY Ph 2,000 lbs (160 psi)	103	128	135
TURNS DISPLACEMENT	4.28	4.90	5.10
R-VALUE UNCORRECTED	24	11	8
R-VALUE CORRECTED	24	11	8

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	1.21	1.42	1.47
EXPANSION PRESSURE THICKNESS, ft.	1.24	0.11	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	25
R-VALUE BY EXUDATION:	9
EQUILIBRIUM R-VALUE:	9